International Journal of Agriculture, Forestry and Fisheries
2020; 8(1): 1-4
http://www.openscienceonline.com/journal/ijaff
ISSN: 2381-4365 (Print); ISSN: 2381-4373 (Online)

Open Science

Effect of Seed Size on *Afzelia africana* (Smith) Germination

Awotedu Bolajoko Folake*, Ogunwande Adedoyin Olusola

Forestry Research Institute of Nigeria, Jericho Hills, Ibadan, Nigeria

Email address

awotedubola@gmail.com (A. B. Folake)

*Corresponding author

To cite this article

Awotedu Bolajoko Folake, Ogunwande Adedoyin Olusola. Effect of Seed Size on *Afzelia africana* (Smith) Germination. *International Journal of Agriculture, Forestry and Fisheries.* Vol. 8, No. 1, 2020, pp. 1-4.

Received: October 20, 2019; **Accepted**: December 19, 2019; **Published**: January 10, 2020

Abstract

Germination is known as a biological process that requires a sufficient supply of water for the growth of the embryo. Seed size plays a vital role as a physical indicator of seed quality which inhibits the vegetative growth related to yield, harvest quality and market grade factor. It has also been shown that seed size affects germination rate, emergence rate, seedling vigor growth and establishment. The experiment was carried out in Tree Improvement section of the forestry research institute of Nigeria. This study was carried out to assess the effect of different seed sizes on *Afzelia africana* germination. They were grouped into 3 categories as large seed size (A), medium seed size (B) and small seed size (C). Different germination parameters like germination percentage (GP), cumulative germination, germination index (GI), germination rate index (GRI) were done. Data collection was analyzed using SPPS. The result shows that small seed size has the highest germination percentage of 83.3, medium 62.5 and large 62.5. For germination index, medium seed size performed best while in the result gotten for germination index rate, seed with large size performed best than others. In conclusion the significant growth observed showed that smaller size seed are good seed size for *A. africana* growth.

Keywords

Germination, Seed, *Afzelia africana,* Emergence, Growth, Integument

1. Introduction

Botanically, a seed can be defined as a developed ovule after fertilization that has an embryonic axis and cotyledons and reserve tissue (at times, not present) that are protected by an integument [1-2]. Long before normal harvesting time, some seeds germinates immediately after fertilization while some seeds rest period takes longer time and needs additional development before germination can occur due to their dormancy. For germination to occur, some environmental conditions like light, temperature, water and oxygen are required for a viable seed [3]. Some seed germination rates are due to their sizes caused by the hard seed coat which stands as a factor for dormancy of such seed and the duration of storage of the seeds [4], germination time Murali [5], germination percentage Molken [6] and seedling vigor Yanlong [7] are being influenced by seed size which also determines the distribution of the plant all over the habitats [8]. Generally, high vigor seed gives higher productivity than seeds with low vigor [9]. In the early stage of plant growth, seed size is considered major factor for germination [10]. Common practice done in most of the plant species is grading of seeds into different sizes and weight which controls germination and subsequent seedling growth in many species. It is considered important in seed germination to know the effect of seed size and weight in order to have vigorous seedlings before been transplanted to the field [11-12] and the grading of seed into seed lot is to know the physiological qualities it possess [13].

Afzelia africana (Sm.) is also known as African mahogany or Africa oak, it's an indigenous leguminous tree species mostly found in West Africa savannahs. The species belongs to the Fabaceae- Caesalpinioideae family. It's a multipurpose tree that has ecological, industrial, socio-economic and cultural values. *A. africana* has a dark brown to black colour

hard seed of 12-17 cm x 5-8 cm x 3-5 cm dimensions which are laid in a pod [14]. Some part of the country calls it different names like gayoki by Fulani's, akpalata by Igbo and apa by Yoruba and kawo by Hausas respectively. The seed has a cup-like waxy structure at the tip, which can be used as a thickener for soup in the eastern part of Nigeria just as melon and *Irvingia gabonensis* seed. It can also be used as charms and for healing of injuries sustained by weapons during war [15]. The fruits can be consumed and has essential classes of food like carbohydrates, protein, vitamins and lipids, the plant parts (roots, leaves and barks) are used as herbal medicine in treating different kinds of diseases and infections such as hernia, malaria, diarrhoea and constipation [16]. The fruit requires 6 months to ripen, it's an oblong, straight flattened, dehiscent pod, 10-20cm long × 5-8cm broad, brown to black in colour. Due to the high importance of *A. africana* in the commercial timber market, little effort is made in establishing massive plantation in spite of felling of the tree that can be found in the wild. This study aims at investigating the importance of seed size of *A. africana* in order to know the best size for rapid and quick germination.

2. Materials and Methods

2.1. Seed Collection

The seeds of *A. africana* were collected at the Tree improvement section of Forestry Research Institute of Nigeria, Jericho hills, Ibadan, Oyo State, Nigeria, was identified and authenticated by a taxonomist at the taxonomy section of the institute. The seeds were then categorized into different sizes (large, medium and small).

2.2. Germination Experiment

By using a metal calliper calibrated in millimetre (mm) length and breadth of the seed were measured. The length and breadth of each seed sizes were obtained. A total of 72 seeds were measured for all the seeds used and were sown in a germination tray. The seeds were monitored daily and the experiment was laid with four replicate. Parameters to be considered are Germination Percentage (GP), Cumulative Germination, Germination Index (GI), Germination Rate Index (GRI).

Germination Percentage (GP) was calculated accordingly using Scott *et al.* [17]

Germination Index (GI) was done according to the formula used by Bench *et al.* [18]

Where GI = Germination index

n = No of seeds germinated each day

Germination Rate index (GRI) was calculated based on Esechie, [19]

Where GRI = Germination rate index

G1 = Germination percentage 100 on the first day of germination

G2 = Germination percentage 100 on the second day of germination

2.3. Statistical Analysis

Data collected were subjected to analysis of variance (ANOVA). Descriptive bar chart was used to describe the relationship between the growth parameters.

3. Results

The range of the seed length and breadth of *A. africana* are large size between 25.72–12.65, medium 22.83-10.89 and small 19.22 -9.36. Germination percentages of different sizes are small 83.3%, medium 62.5%, and large 62.5%.

3.1. Germination Mean

This Figure 1 shows that the small size (5.0) of *A. africana* performed best while medium (3.75) and large sizes (3.75) performed equally.

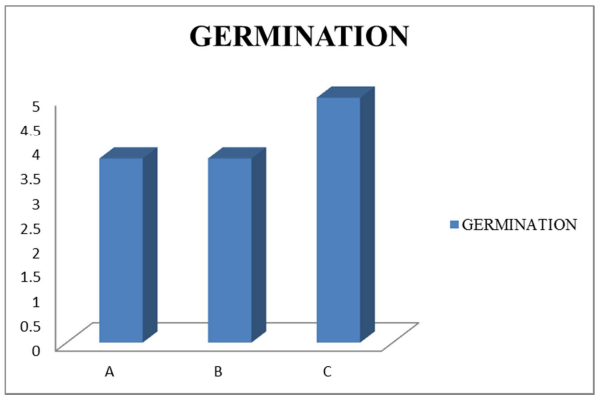

Figure 1. *Germination means of large, medium and small size of A. africana.*

3.2. Cumulative Count

Figure 2 indicates that small size (20) of *A. africana* has the highest cumulative count, large (15) and medium-size (15) gave the same cumulative count.

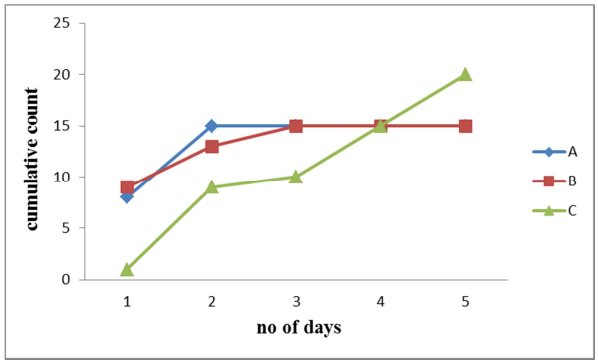

Figure 2. *Different sizes of A. africana cumulative count.*

3.3. Germination Index

The result of the germination index is expressed in Figure 3 and in the germination parameter the medium-size of *A. africana* performed best followed by the small size while the large size performed least.

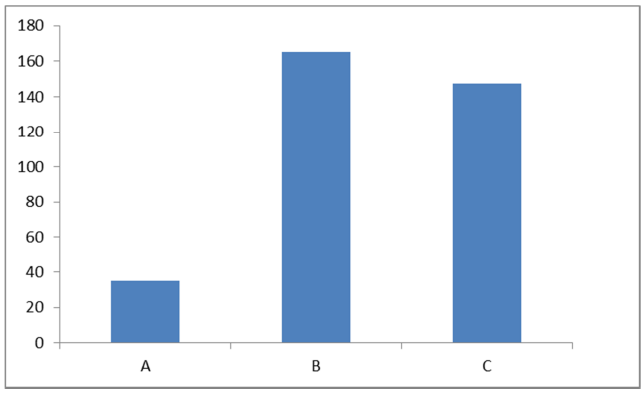

Figure 3. *Germination index of Afzelia africana.*

3.4. Germination Rate Index

Figure 4 *A. africana* large seed size performed best in this parameter, followed by medium-size and small size performed least.

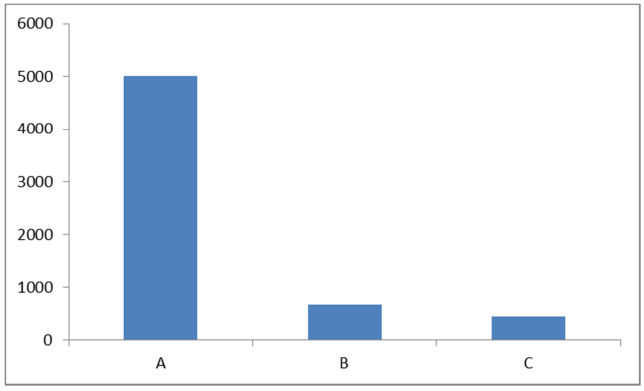

Figure 4. *Germination rate index of Afzelia africana.*

4. Discussion

This study investigates the effect of seed size of *Afzelia africana* germination. The germination studies conducted for the three seed sizes (A- Large, B- Medium, C- Small), the results for germination percentage shows the small seed size gave maximum 83.3%, while large seed size gave 62.5% and medium seed sizes gave 62.5% each. This result is the same with Souza and Fagundes [20] who reported that small seed size of *Copaifera langsdorffii* performed best. However, Ahirwar [21] in his findings also reported that, smaller size seeds germinated better in *Cassia fistula, Cassia hybrida, Acacia holosericea* and *Acacia concinna. Afzelia africana* seed germination was affected by seed size. The germination time needed for small seeds are lesser than the large seeds and germinates faster to give greater competitiveness before usual successional stages [5]. Nevertheless, seeds with large sizes slowly germinates and usually have higher germination percentage than seeds with small size favored in predictable habitat. In predicting strong influence on germination, seedling growth rate, development and biomass increment of a plant in nursery establishment, seed size can be used a parameter [22] and it depends on the environmental conditions and genotype in which they are developed. Adegoke [23] reported that large seeds of *khaya senegalensis* performed best in germination index (GI) while in this study, medium seed size performed best. The result gotten for *Afzelia africana* germination rate index (GRI) in this study supports the findings of Adegoke [23] that large seed size did best. However, seed size may affect initial seedling growth, but not final seed yield.

5. Conclusion

According to this study, the germination parameter for the different seed sizes of *A. africana* was determined. The small seed size has the best germination percentage of 83.3. Therefore, in raising *A. africana* seedling small seed size is suggested, this will help increase seedling availability for reforestation and domestication projects. High seed quality is a necessity to give optimum seed germination and seedling vigor and the seed quality is also reflected in the final growth, maturity of plants, their uniformity and stability of yield. For a seed to play an important role, it should reach farmers in a good quality state.

References

[1] Beltrati C. M. and Paoli A. A. S. (2003). Seed In: Plant Anatomy, Apezzato-da-glória, B. and S. M. Carmello-Guerreiro (Eds.). Universidade Federal de Viçosa, Viçosa, pp: 399-424. doi=ijb.2008.303.308.

[2] Fenner M. (2004) Seed size and chemical composition: the allocation of minerals to seeds and their use in early seedling growth. Botanical Journal of Scotland 56: 163–173 doi: 10.1080/03746600408685076.

[3] Martínez-Andújar C. and Nonogakim H. (2018) Germination. Access Science DOI: https://doi.org/10.1036/1097-8542.900110.

[4] Nwoboshi L. C. (1982). Tropical Silviculture Principles and Techniques. Ibadan University Press Publishing House, Ibadan, Nigeria, pp. 330-333.

[5] Murali K. S. (1997) Patterns of Seed Size, Germination and Seed Viability of tropical Tree Species in Southern India. Biotropica, 29: 271-279. http://dx.doi.org/10.1111/j.1744-7429.1997.tb00428.x.

[6] Tamara Van Molken, Linda D, Jorritsman-Wienk, Paul H. W. van Hoek and Hans de Kroon. (2005) Only seed size matters for germination in different of the Dimorphic Tragopogon Pratensis SUBSP. PRATENSIS (ASTERACEAE). American Journal of Botany, 92 (3): 432-437.

[7] Yanlong H., Mantang W., Shujun W., Yanhui Z., Tao M. and Guozhen D. (2007) Seed Size Effect on Seedling Growth under Different Light Conditions in the Clonal Herb Ligularia virgaurea in Qinghai-Tibet Plateau. Acta Ecologica Sinica, 27: 3091-3108. http://dx.doi.org/10.1016/S1872-2032(07)60063-8.

[8] Silveira F. A. O., Negreiros D., Araújo L. M. and Fernandes G. W. (2012) Does Seed Germination Contribute to Ecological Breadth and Geographic Range? A Test with Sympatric Diplusodon (Lythraceae) Species from Rupestrian Fields. Plant Species Biology, 27: 170-173. http://dx.doi.org/10.1111/j.1442-1984.2011.00342.x.

[9] Scheeren, B. R., Peske, S. T., Schuch, L. O. B., Barros, A. C. A. (2010). Qualidade Fisiológica E Produtividade De Sementes De Soja. Revista Brasileira De Sementes, 32 (3): 35-41. Http://Dx.Doi.Org/10.1590/S0101-31222010000300004.

[10] Girish B., Shahapurmath G. R., Kumar A. K. K and Ganiger B. S. (2001). Effect of seed size and depth of sowing on seed germination in Sapindus trifoliatus, My Forest, 37: 483-48.

[11] Nagarajan M. and Mertia R. S. (2006). Effect of Seed Size and sowing depth on germination and seedling growth of Colophospermum mopane (Kirh ex Benth) Kirt ex J. Leon, Indian Forester, 132 (8): 1007-1012.

[12] Negi A. K. and Todaria N. P. (1997). Effect of seed size and seed weight on germination pattern and seedling development of some multipurpose tree species of Garhwal Himalaya, Indian Forester, 123 (1): 32-36.

[13] Dar Farooq Ahmad, Gera Mohit and Gera Neelu (2002). Effect of seed grading on germination pattern of some multipurpose tree species of Jammu region, Indian Forester, 128 (5): 509-513.

[14] Orwa C., Mutua A., Kindt R., Jamnadass R. and Anthony S. (2009) Agroforestry Database: A Tree Reference and Selection Guide Version 4.0. World Agroforestry Centre Kenya. http://www.worldagroforestry.org/sites/treedbs/treedatabases.asp.

[15] Igwe O. U., Friday C. (2017). Volatile constituents of hydrocolloids isolated from Afzelia africana and Detarium microcarpum seeds. Chemistry International, 3 (4): 286-291.

[16] Alyaa A. E. D., Abdeimoniem M. A., Abdelhalim B. (2015). Phytochemical screening, antimicrobial and cytotoxicity of different extracts of Afzelia africana bark. International Journal of Innovativ Pharmaceutical Sciences and Research 3 (1): 49-58.

[17] Scott S., Jones R. and Williams W. (1984) Review of data analysis methods for seed germination. Crop science, 24: 1192-1199.

[18] Bench A. R., Fenner M. and Edwards P. (1991). Changes in germinability, ABA content and ABA embryonic sensitivity in developing seeds of sorghum bicolor (L.) Moench induced by waterstress during grain filling. New phytologist, 118: 339–347.

[19] Esechie H. (1994). Interraction of salinity and temperature on the germination of sorghum. Journal of Agronomy and Crop Science, 172: 194–199.

[20] Matheus Lopes Souza and Marcílio Fagundes (2014) Seed Size as Key Factor in Germination and Seedling Development of Copaifera langsdorffii (Fabaceae) American Journal of Plant Sciences.5: 2566-2573 doi.org/10.4236/ajps.2014.517270.

[21] Ahirwar J. R. (2012) Effect of seed size and weight on seed germination of Alangium lamarckii, Akola, India Research Journal of Recent Sciences, l: 320-322.

[22] Simmone R. Ter Steege H. and Werger M. (2000). Survival and growth in gaps–A case study for tree seedlings of 8 species in the Guyanese Tropical Rainforest in seed seedlings and gap size matters. Troplenbos-Guyana programmes.

[23] Adegoke F. F., Ogunwande O. A. and Onilearo K. S. (2019) Seed weight- germination Relationships and Early seedling development of Khaya senegalensis (Desr.) A. Juss International journal of Applied Research and Technology. 8 (1): 170–178.